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G.I.-30 SEPT. 1976

GEOCREs No. 40I13-33
DIST. 1 REGION Southwestern
W.P. No. 42-66-14
CONT. No. 76-122
W. O. No.
STR. SITE No. 14-361
HWY. No. 402
LOCATION Township Road
Underpass

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 3

REMARKS: documents to be unfolded
before microfilming

FOUNDATION INVESTIGATION REPORT

For

Township Road Underpass at
Lambton and Middlesex County Line
4.6 Miles East of Hwy. 79
Hwy. 402, District 1, Chatham
W.P. 42-66-14

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project. Field work was done during the period June 3rd to 8th, 1971, utilizing a continuous flight auger machine equipped with 4 inch O.D. solid augers.

SITE DESCRIPTION

The site is located some 4.6 miles east of Hwy. 79 in Lots 1 and 30, Con. 1 and 2 S.E.R. Townships of Adelaide and Warwick, Counties of Middlesex and Lambton, at the intersection of Hwy. 402, Line 'C' and an existing gravel road. The surrounding area is generally flat with scattered scrub and trees. On the east side of the gravel road there is a 12 foot wide, 4 foot deep drainage ditch. At the time of the investigation water was flowing in the ditch. Physiographically the site is located in the region referred to as the Horseshoe Moraines.

SUBSURFACE CONDITIONS

General

Subsoil at the site consists of about 73 feet of firm to very stiff clayey silt overlying bedrock. Reference should be made to the Record of Borehole sheets contained in the report Appendix on which are shown the results of laboratory and field tests carried out during the investigation and the boundaries and descriptions of the soil types. Reference should also be made to Drawing No. 14-361-2 of the Contract Drawings which shows the locations and elevations of the borings, together with the inferred soil stratigraphy. A detailed description of the subsoil types encountered is given below.

Sand and Gravel

This is fill material in the gravel road and is about 1.5 feet in thickness. It consists of well graded sand and gravel.

Clayey Silt (Glacial Till)

This is the predominant soil deposit and was found in all boreholes. The thickness of the deposit varies from 73 to 74 feet.

The material, in general, consists of clayey silt with varying amounts (traces to some) of sand, and traces of gravel. The percentages of sand and gravel gradually increase with depth. There were occasional silt and/or fine sand seams, less than 1 inch to more than 1 foot in thickness. These seams were apparently randomly distributed but were more numerous in the upper half of the deposit. It is believed that these seams are water bearing.

The consistency of the material varies from firm to very stiff. Field vane tests indicate that the undrained shear strength varies from 1,280 p.s.f. to greater than 2,000 p.s.f. Only two laboratory unconfined compression tests were carried out to determine the undrained shear strength and the results were 700 and 1,120 p.s.f.

Physical properties of the cohesive material as determined from laboratory tests are as follows (see Fig. 1):

		<u>Min.</u>	<u>Max.</u>	<u>Average</u>
Liquid Limit	(%)	24	37	27
Plastic Limit	(%)	16	21	17
Natural Moisture Content	(%)	13	23	22

Grain size analyses performed on the same material indicate the following distributions and are plotted on Fig. 2.

		<u>Min.</u>	<u>Max.</u>
Gravel	(%)	0	9
Sand	(%)	0	16
Silt	(%)	57	86
Clay	(%)	16	41

Colour of the material was gray except for the upper 6-7 feet where it was brown.

30

Bedrock

No bedrock was proven but in all boreholes the bedrock surface was assumed to be the level at which practical refusal to augering and/or to driving the split spoon was reached. The bedrock surface thus determined is relatively level and varies from elevation 703.3 to 704.1.

Groundwater

The following water levels were observed during the field work:

Borehole 1	Elevation 773.2
2	773.3
3	773.1

Because the clayey silt material itself is relatively impermeable, therefore the seepage of water into the boreholes indicates that the silt and/or fine sand partings act as water bearing seams.

K. G. Selby

K.G. Selby, P. Eng.
Supervising Engineer

KGS/PS/gs
December, 1976

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 42-66-14 LOCATION Sta. 101 ± 26 o/s 6' Lt. & Twp. Rd. ORIGINATED BY AP
 DIST 1 HWY 402 BORING DATE June 8, 1971 COMPILED BY KW
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone Test CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT Y PCF	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
777.2	Ground Level															
775.7	Fill. Sand & gravel	X														
1.5			1	SS	3											
	Brown		2	SS	16											
	Grey		3	SS	21										0 0 (100)	
	Clayey silt, traces to some sand (increasing with depth), traces of gravel, occasional silt &/or fine sand seams (Glacial Till) Firm to Very Stiff		4	TW	PH											
			5	TW	PH										125	0 1 74 25
			6	TW	PH											
			7	SS	17											0 16 63 21
			8	SS	20											
			9	SS	26											7 11 60 22
			10	SS	27											
703.7																Refusal to Augering
73.5		End of Borehole Probable Bedrock Note: W.L. estimated														

OFFICE REPORT ON SOIL EXPLORATION

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 42-66-14 LOCATION Sta. 99 + 98 o/s 7' Rt. & Twp. Rd. ORIGINATED BY AP
 DIST 1 HWY 402 BORING DATE June 3 - 4 1971 COMPILED BY KW
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone Test CHECKED BY *SO*

SOIL PROFILE		SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH PSF ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 1000 2000 3000 4000 5000	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L WATER CONTENT % 10 20 30	UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE					
777.3	Ground Level								
775.8	Fill, Sand & gravel	X							
1.5	Brown Grey		1	SS	6				0 2 57 41
			2	SS	31				0 0 84 16
			3	SS	20				
			4	SS	9				
	Clayey silt traces to some sand		5	TW	PH				
	(increasing with depth), traces of gravel, occasional silt &/or fine sand seams		6	SS	10				0 6 69 25 0 3 88 9
	(Glacial Till)		7	TW	PH				
	" Firm to Very Stiff		8	SS	23				0 14 61 25
			9	SS	27				
			10	SS	20				7 30 50 13
703.3			11	SS	150/0"				Hammer bouncing
74.0	End of Borehole Probable Bedrock								refusal to augering

OFFICE REPORT ON SOIL EXPLORATION

20
15 \diamond 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

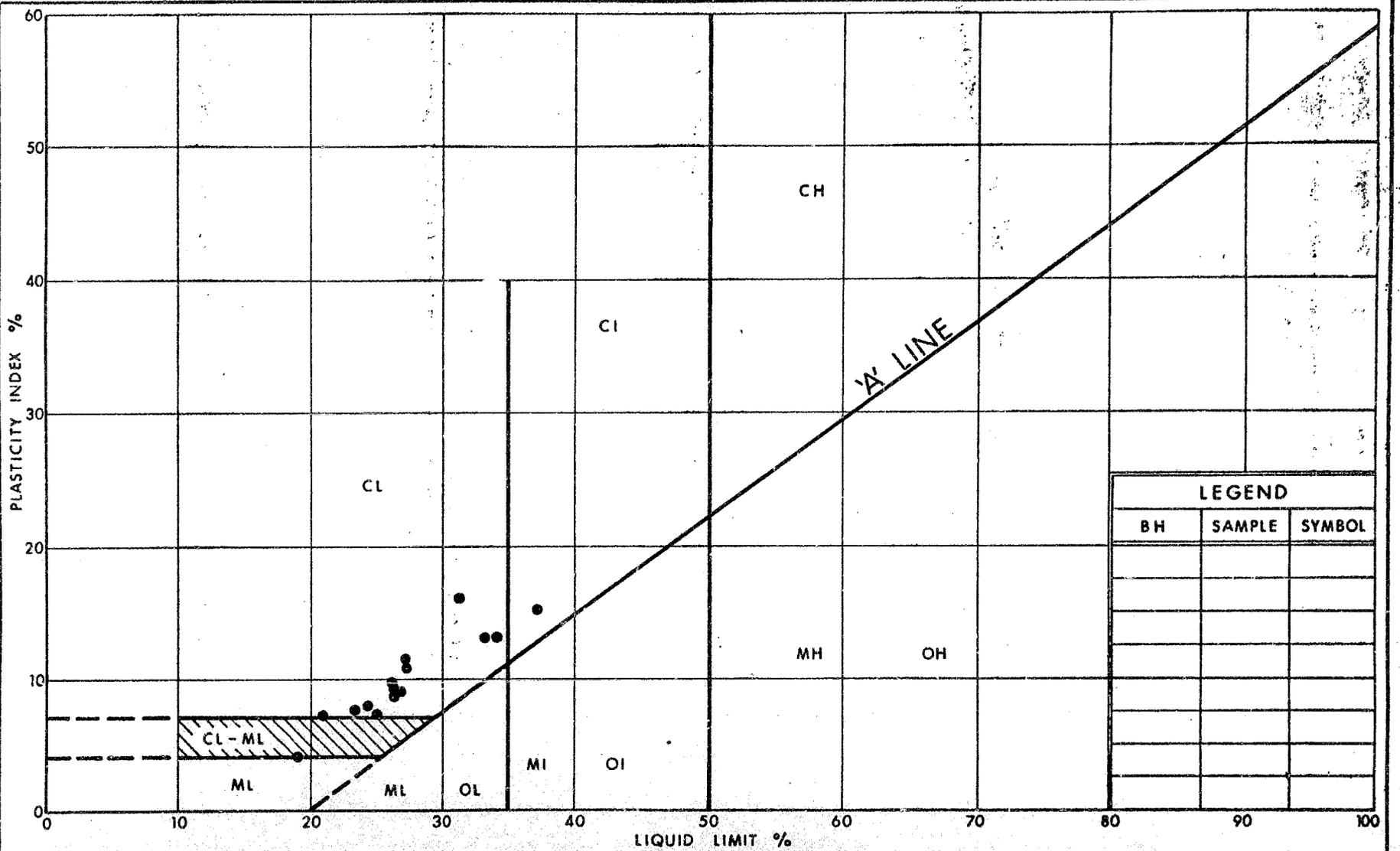
RECORD OF BOREHOLE NO 3

WP 42-66-14 LOCATION Sta. 98 + 71 o/s 5' Lt. & Twp. Rd. ORIGINATED BY AP
 DIST 1 HWY 402 BORING DATE June 7, 1971 COMPILED BY KW
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone Test CHECKED BY

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ PCF	REMARKS % GR SA SI CL	
			NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w			w_L
777.1	Ground Level															
775.6	Fill. Sand & gravel		1	SS	20											
1.5	Brown Grey silt Clayey silt, traces to some sand (increasing with depth) traces of gravel, occasional silt &/or fine sand seams (Glacial Till) Stiff to Very Stiff	[Hatched pattern]	2	SS	27	770									0 1 64 35	
			3	SS	-											
			4	TW	PH	760										
			5	TW	PH											
			6	TW	PH	750	6	sl. 2 +						128		0 3 86 11 1 21 60 18
			7	SS	12											
			8	SS	15	740										3 15 53 29
			9	SS	29	730										
			10	SS	25	720										9 6 62 23
			710													
704.1	Sand and gravel		11	SS	101.6"									Hammer bouncing 8 64 (28)		
73.0	End of Borehole Probable Bedrock													refusal to augering		

OFFICE REPORT ON SOIL EXPLORATION

20
15 ϕ 5 % STRAIN AT FAILURE
10





Memorandum

To: Mr. A. Wittenberg,
Regional Manager,
Reg. Planning & Design,
Southwestern Region, London.

From: Structural Office,
West Building, Downsview.

Attention: Date: June 18, 1976.

Our File Ref. In Reply to

Subject: W. P. 42-66-14, Site 14-361
(W.P. 41-66-01)
Township Road Underpass,
Highway 402, District 1

Please find enclosed four sets of prints of drawings
14-361-1 and 3 to 16 inclusive.

One print of drawing 14-361-1 is being forwarded to the
Systems Design Project Review Section.

One set of prints is also being forwarded to the following:

- Estimating Section
- Regional Structural Planning Engineer
- Assistant Construction Engineer (Structures)
- District Office
- Structural Maintenance Engineer
- Soil Mechanics Section.

The D4 and Special Provisions were mailed to you previously.

NZ/cf
Enc.

N. Zoltay,
Structural Contract
Specifications Engineer.

- c.c. J. Wear
- B. Giroux
- A. Watt
- A. McKim
- A. Kelly
- E. Van Beilen
- C. Mirza
- A. Crowley
- J. Anderson



FOUNDATION INVESTIGATION REPORT
For
Proposed Crossing at
C.A.H. 402, Line 'C' and Twp. Road
(4.6 miles east of Hwy. 79)
Twps.: Warwick & Adelaide
Cos: Lambton & Middlesex
District #1 (Chatham)
W.O. 71-11044 --- W.P. 42-66-14

1. INTRODUCTION:

A request for a foundation investigation at the crossing of the proposed C.A.H. 402, Line 'C' and Township Road, 4.6 miles east of Hwy. 79, was received from Mr. A.P. Watt, Regional Bridge Planning Engineer, in a memorandum dated April 13, 1971.

A field investigation was subsequently carried out by the Foundation Section to determine the subsoil conditions existing at the site. This report contains the results of this investigation and our recommendations pertaining to the design of the proposed structure foundations and approach embankments.

2. DESCRIPTION OF THE SITE:

The site of the proposed structure is situated about 8 miles east of Warwick, approximately 1 mile south of Hwy. 22.

The surrounding area is flat with scattered scrub and trees on both sides. On the east side of the road, there is a 4 ft. deep and about 12 ft. wide drainage ditch running parallel to the Township Road. At the time of investigation, there was water flowing through the ditch.

2. DESCRIPTION OF THE SITE: (cont'd) ...

Physiographically, the site is located in the region referred to as the Horseshoe Moraines.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES:

A total of three sampled boreholes and three dynamic cone penetration tests were carried out during the course of the field work. Boring was achieved by means of a continuous flight auger machine. During the field work, disturbed samples were obtained by means of a standard split-spoon sampler: the energy used in driving it, conformed to the requirements of the Standard Penetration Test. Undisturbed samples were recovered using 2-inch I.D. Shelby tubes which were pushed into the soil hydraulically, or by hand. Where possible, field vane tests were carried out at elevations 12 inches below sample depths.

Dynamic cone penetration tests were carried out adjacent to each borehole. Driving energy used to advance the cone was 350 ft. - lbs. per blow.

All boreholes were surveyed in the field by personnel from London Region Engineering Survey Section. The locations and elevations of the borings are shown on Drawing No. 71-11044A, which accompanies this report.

All samples were visually examined and classified at the site as well as in the laboratory. Following this inspection, laboratory tests were carried out on selected samples to determine the following physical properties:

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES: (cont'd) ...

Atterberg Limits

Moisture Content

Grain-Size Distribution

Undrained Shear Strength

Bulk Density

Consolidation Characteristics

The test results are summarized on the Record of Borehole sheets contained in the Appendix of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

Generally, uniform subsoil conditions were found to prevail over the area investigated. The subsoil consists of a deep deposit of clayey silt with traces of sand, overlying bedrock.

The boundaries between various soil types are shown on the Record of Borehole sheets. The estimated stratigraphical profile shown on Drawing No. 71-11044A is based upon this information.

From ground level downward, the various strata are described in some detail with regard to soil types and soil properties, as follows:

4.2) Fill, Sand and Gravel:

This material was found in all boreholes to depths of 1.5 ft., and constitutes the fill placed for the gravel road. It consists of sand and gravel.

4.3) Clayey Silt:

This was the predominant soil deposit, and was found in all boreholes. All boreholes were terminated into this layer. The thickness of the deposit varies from 73.0-74.0 ft.

4. SUBSOIL CONDITIONS: (cont'd) ...

4.3) Clayey Silt: (cont'd) ...

The material, in general, consists of clayey silt with varying amounts (traces to some) of sand, and traces of gravel. The percentage of sand and gravel gradually increases with depth. There were occasional silt and/or fine sand seams, less than 1 inch to more than 1 ft. in thickness. These seams were apparently randomly distributed, but were more numerous in the upper half of the deposit. It is felt that these seams are water bearing.

The consistency of the material varies from firm to very stiff. Field vane tests indicate that the undrained shear strength varies from 1,280 p.s.f. to greater than 2,000 p.s.f. Only two laboratory tests were carried out to determine the undrained shear strength, and the results vary from 700 to 1,120 p.s.f.

Physical properties of the cohesive material, as determined from laboratory tests are as follow: (see Fig. 1)

		<u>Min.</u>	<u>Max.</u>	<u>Average</u>
Liquid Limit	(%)	24	37	27
Plastic Limit	(%)	16	21	17
Natural Moisture Content	(%)	13	23	22

Grain-size analyses performed on the same material indicate the following distributions, and are plotted on Fig. 2.

		<u>Min.</u>	<u>Max.</u>
Gravel	(%)	0	9
Sand	(%)	0	16
Silt	(%)	57	86
Clay	(%)	16	41

4. SUBSOIL CONDITIONS: (cont'd) ...

4.3) Clayey Silt: (cont'd) ...

Colour of the material was gray, except for the upper 6 - 7 ft., where it was brown.

4.4) Bedrock:

No bedrock was proven, but in all boreholes the bedrock surface was assumed to be the level at which practical refusal to augering and/or to driving the split-spoon was reached. The bedrock surface is relatively level and varies from Elevation 703.3 to 704.1.

5. GROUNDWATER CONDITIONS:

The following water levels were observed during the field work:

Borehole	1	Elevation	773.2
	2		773.3
	3		773.1

Because the clayey silt material itself is relatively impermeable, therefore, the seepage of water into the boreholes indicates that the silt and/or fine sand partings act as water bearing seams.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct a two-span (126'-126') underpass structure at the crossing of new Hwy. 402, Line 'C' and Township Road, 4.6 miles east of Hwy. 79. The proposed grade of Hwy. 402 will be at approx. elevation 777.0, i.e., the

6. DISCUSSION AND RECOMMENDATIONS: (cont'd) ...

6.1) General: (cont'd) ...

same as the present grade of the Township Road. The future grade of the Township Road will be at approximate elevation 799.0, resulting in a maximum approach height of about 22 ft.

In general, the subsoil at the site consists of about 73 ft. of firm to very stiff clayey silt with traces of sand, overlying bedrock.

6.2) Foundations:

a) Spread Footings in Original Ground

The entire structure may be supported on spread footings placed at approximate Elevation of 770.0 in the desiccated zone of the subsoil. A safe net pressure of 2.0 tons/sq. ft. may be used for design purposes.

The upper zone of the subsoil is desiccated and is, therefore, susceptible to softening on contact with water. Therefore, it is recommended that the base of the footing excavations be protected by a concrete working slab, immediately on exposure. Because the silt and/or sand seams are water bearing and if they are intersected while excavating, an inflow of water from the sides into the excavation may be expected. If one of the seams occurs at the bottom of excavation, then some loosening of silty material may occur, because of unbalanced hydrostatic head. In that case it will be necessary to excavate slightly deeper down to the cohesive material and the loose material will be removed. However, no major problems are anticipated.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd) ...

6.2) Foundations: (cont'd) ...

b) Spread Footings on Compacted Fill:

As an alternative, the abutments may be supported on spread footings placed on well compacted, suitable granular material within the approach fills. A safe design load of 2.0 TSF may be assumed. The granular material should consist of G.B.C. Class 'A' and should be fully compacted according to the current D.H.O. Standards. A detailed construction scheme is outlined on Figure 3 of the Appendix.

c) Perched Abutments on Short Piles:

As a second alternative, the abutments may be constructed within the approach fills and supported on short piles driven through the fill and some 10.0 ft. into the original ground. In the case of 12-3/4" O.D. and 1/4" thick wall steel tube piles, a safe design load of 25 tons per pile may be used.

It is estimated that the following maximum settlements will occur in the subsoil at various locations over a long period of time following the end of construction.

Pier -	Spread footings in original ground	1.0 - 1.5 inches
Abutment -	Spread footings in original ground	} 3.0 - 4.0 inches
	Spread footings on compacted fill	
	Perched abutments on short piles	

Regardless of which of the above methods is adopted, the structure should be built to accommodate the 3.0 inches differential settlements between the abutments and the pier.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd) ...

6.2) Foundations: (cont'd) ...

d) End-Bearing Piles:

As another alternative, the abutments and pier may be supported on steel H-piles driven to refusal into the bedrock. For design purposes the maximum allowable design load may be used for the particular steel section used.

All foundations and pile caps should be protected against frost action by at least 4 ft. of earth cover.

6.3) Approach Embankments:

The shear strength of the subsoil is such that it will be able to safely support the 22-ft. high approach embankments constructed with 2:1 side slopes. The fill should consist of well compacted acceptable material. Care should be taken to ensure that no bouldery fill is placed within the approaches through which piles have to be driven, and it is recommended that this portion of the fill contain no larger grain sizes than 3 inches.

Based on the performance of structures and embankments built in the same general area and with somewhat similar subsoil conditions, it is estimated that maximum settlements of 3 to 4 inches will occur beneath the abutment locations. To minimize the effect of differential settlements between the abutments and pier footings, it is recommended that the approach embankments be built in advance of the structure for as long a period as possible. The topsoil and any organic material should be removed in accordance with the pertinent D.H.O. Standards within the construction area.

7. MISCELLANEOUS:

The field investigation was carried out during the period June 3- 8, 1971, under the supervision of Mr. A. Prakash, Project Foundation Engineer, who also prepared this report.

Equipment was owned and operated by Dominion Soil Investigation Ltd.

This report was reviewed by Mr. K. C. Selby, Supervising Foundation Engineer.

June, 1971

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-11044 LOCATION Twp. Rd. Sta. 101 + 26 o/s 6' Lt. ORIGINATED BY AP
 W.P. 42-66-74 BORING DATE June 8, 1971 COMPILED BY KW
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone CHECKED BY ///

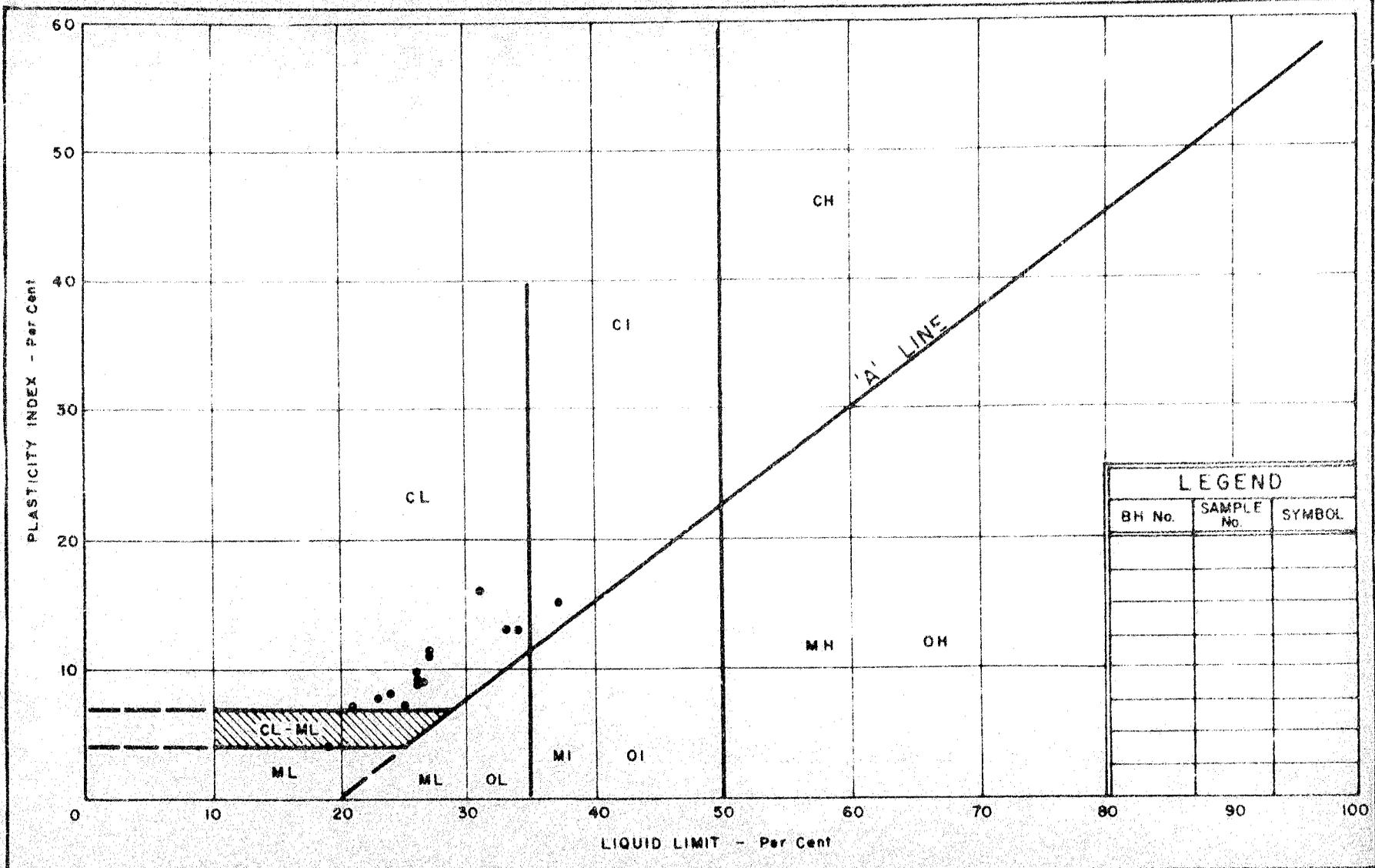
ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS	
			NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	SHEAR STRENGTH P.S.F.					WATER CONTENT %
777.2	Ground Level																
775.7	Fill. Sand & Gravel																
1.5			1	SS	3												773.2 (estimated)
	Brown Grey		2	SS	16	770											0 0 (100)
			3	SS	21												
			4	TW	PH	760											
	Clayey silt, traces to some sand (increasing with depth) traces of gravel. Occ. silt &/or Fine sand seams. (Glacial Till)		5	TW	PH												125 0 1 74 25
			6	TW	PH	750											
			7	SS	17												0 16 63 21
	Firm to Very Stiff		8	SS	20	740											
			9	SS	26	730											7 11 60 22
			10	SS	27	720											
						710											
703.7																	Refusal to augering
73.5	End of Borehole Probable Bedrock					700											

JOB 71-1104 LOCATION TWP. Rd. Sta. 99 + 98 o/s 7' Rt. ORIGINATED BY AP
 W.P. 42-66-14 BORING DATE June 3 - 4, 1971 COMPILED BY KW
 DATUM Geodetic BOREHOLE TYPE CME Flight Auger & Cone CHECKED BY [Signature]

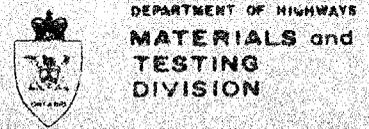
ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — w _L PLASTIC LIMIT — w _p WATER CONTENT — w			BULK DENSITY γ	REMARKS
			NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	w _p	w		
777.3	Ground Level														
775.8	Fill, Sand & Gravel														
1.5	Brown Grey		1	SS	6										773.3
			2	SS	31	770									0 2 57 41
			3	SS	20										
			4	SS	9	760									0 0 84 16
	Clayey silt		5	TW	PH										
	Traces to some Sand silt (increasing with depth) traces of gravel.		6	SS	10	750									0 6 69 25 0 3 88 9
	occ. silt &/or Fine sand seams. (glacial till)		7	TW	PH										
	Firm to Very Stiff		8	SS	23	740									0 14 61 25
			9	SS	27	730									
			10	SS	20	720									7 30 50 13
			11	SS	150/0"	710									
703.3	End of Borehole														Hammer bouncing refusal to augering
74.0	Probable Bedrock														

JOB 71-11044 LOCATION Two. Rd. Sta. 98 + 71 o/s 5' Lt. ORIGINATED BY AP
 W.P. 42-66-14 BORING DATE June 7, 1971 COMPILED BY KW
 DATUM Geodetic BOREHOLE TYPE GME Flight Auger & Cone CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — W _L PLASTIC LIMIT — W _p WATER CONTENT — W			BULK DENSITY γ _p P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	20	40	60	80	100			W _p	W
777.1	Ground Level														
775.6	Fill. Sand & Gravel														
			1	SS	20										
	Brown Grey		2	SS	27	770									
			3	SS	-										
			4	TW	PH	760									
			5	TW	PH										
	Silt		6	TW	PH	750									128
	Clayey silt, traces to some sand (increasing with depth), traces of gravel occ. silt &/or fine sand seams. (Glacial Till) Stiff to Very Stiff		7	SS	12										
			8	SS	15										
			9	SS	29										
			10	SS	25										
			11	SS	100/6"										
704.1	Sand & gravel														
73.0	End of Borehole Probable Bedrock														

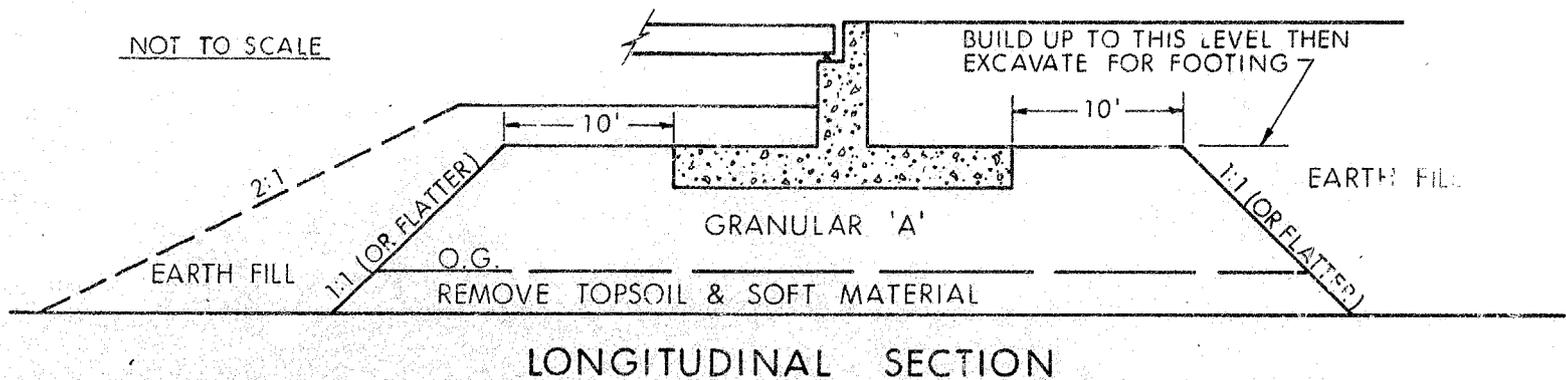
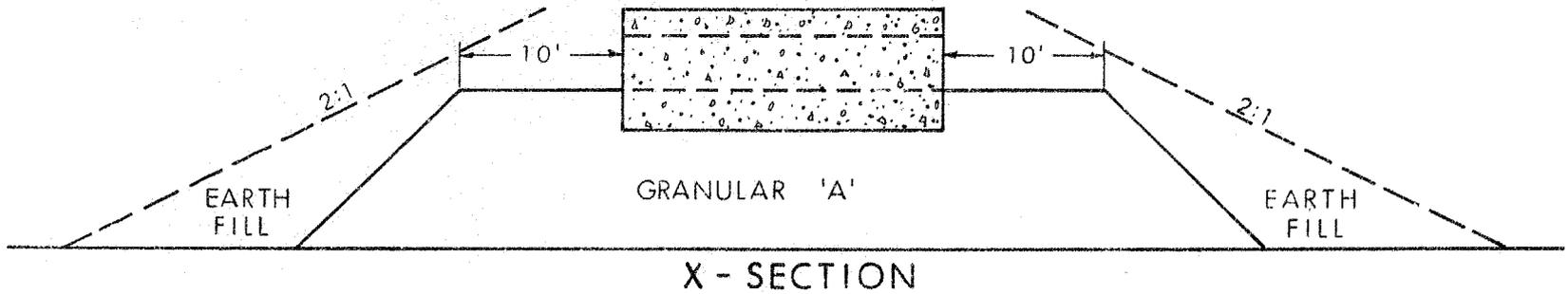


PLASTICITY CHART
 CLAYEY SILT



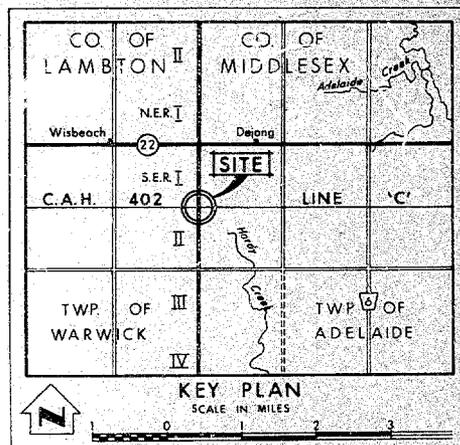
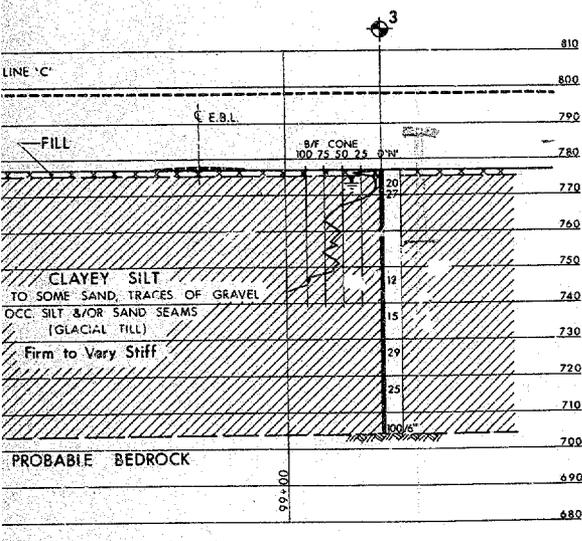
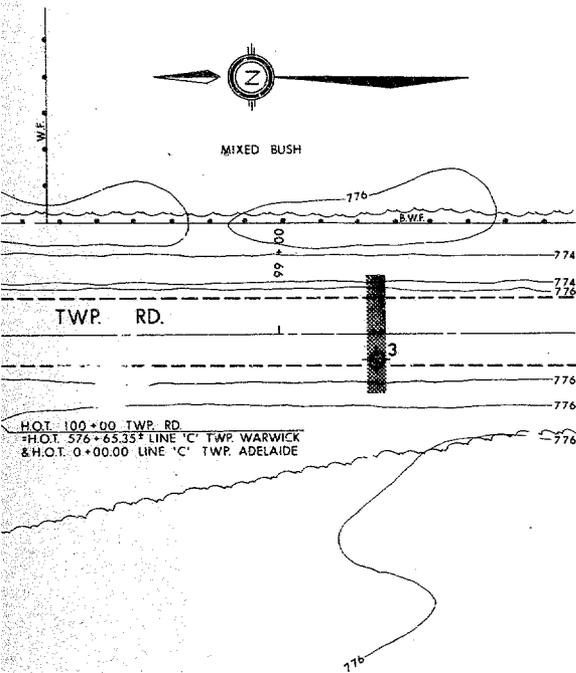
WP No. 42-66-14
 JOB No. 71-11044
 FIG. 1

ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



NOTES

- 1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A'.
- 2 - PLACE GRANULAR 'A' TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT D.H.O. STANDARDS.
- 3 - EXCAVATE COMPACTED GRANULAR 'A' MATERIAL FOR FOOTING.



LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation: JUNE 1971		
NO.	ELEVATION	STATION	OFFSET
1	777.2	101+26	6' LT.
2	777.3	99+98	7' RT.
3	777.1	98+71	5' LT.

— NOTE —
 The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
 DESIGN SERVICES BRANCH — FOUNDATION SECTION

TOWNSHIP ROAD
 4.6 MILES EAST OF HWY. NO. 79

HIGHWAY NO. 402 LINE 'C' DIST. NO. 1

CO. MIDDLESEX & LAMBERTON

TWP. ADELAIDE & WARWICK LOT 1 & 30 CON. 1 & 2 S.E.R.

BORE HOLE LOCATIONS & SOIL STRATA			
SUBMD. A.P.	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 42-66-16	M.E.T. DRAWING NO.
DRAWN A.N.	CHECKED <input checked="" type="checkbox"/>	JOB NO. 71-11044	71-11044 A
DATE 29 JUNE 1971	SITE NO.		BRIDGE DRAWING NO.
APPROVED	CONT. NO.		



Memorandum

1283

To: Mr. A. Wittenberg,
Manager, Planning and Design,
London.

From: Materials and Testing Office,
London.

Attention: Mr. T. A. Hickey.

Date: April 20, 1976.

Our File Ref.

In Reply to

Subject: W.P. 41-66-01, Highway 402,
Township of Adelaide,
Culvert Sites, London District.

(42-66-14)

As a follow up to our memo dated March 1, 1976 proposed culvert sites in Adelaide Township were checked in the field to determine subsoil conditions at the respective sites. A backhoe was used to dig test holes where access could be made with this type of equipment. Shear tests were attempted at the sites as well but it was not possible to penetrate and turn the vane in the firm clay subsoil.

From our survey it was noted that a firm medium clay till was encountered at the footing level at the following sites and that a safe bearing capacity of 3.0 kips per square foot may be used for design.

<u>Station</u>	<u>Top of Footing Elevation</u>
216 + 20	792.5
230 + 80	786.3
252 + 80	789.0
387 + 00	787.3
416 + 16	797.5
519 + 00	806.0
533 + 30	801.2

In view of these conditions, it is also recommended that 3.0 kips per square foot be used in design at the following sites where test holes were not possible due to bush areas or permission to enter could not be obtained.

<u>Station</u>	<u>Top of Footing Elevation.</u>
130 + 00	773.4
320 + 90	774.1
348 + 28	778.8

It is recommended that these latter sites be reviewed closely in the field once the excavation has been dug to ensure a firm foundation for the culvert footings.



We are forwarding field data, together with laboratory results in order that it may be placed on the Contract Drawings.

JMcK:hp.
ATT'D.

- c.c. - D. P. Collins,
- J. Wear,
- G. A. Wrong,
- K. Kelby,
- A. Watt,
- J. McKeown,
- File.

J. McKeown for J.G.
J. McKEOWN,

FOR: J. G. FORSTER,
SENIOR SOILS ENGINEER.

216+20 E Blvd.

0	-	8"	Tps		
8"	-	10 ⁰	Br M CI Till (wet to 24")	<u>76AX67</u>	
			Br M CI	VF & F Sa	8
				Si	34
				CI	58
				VF Sa&Si	42
				LL	34.6
				PL	17.5
				PI	17.1
				FMC	17.2

230+80 E Blvd.

0	-	12"	Tps		
12"	-	10 ⁰	Br M CI Till	<u>76AX68</u>	
				F&VF Sa	8
				Si	37
				CI	55
				VF Sa&Si	45
				LL	33.9
				PL	18.5
				PI	15.4
				FMC	18.0

252+00 E Blvd.

0	-	12"	Tps		
12"	-	7 ⁰	Br M CI Till (wet to 4 ⁰)		
7 ⁰	-	10 ⁰	Gry M CI Till	<u>76AX69</u>	
				F&VF Sa	10
				Si	34
				CI	56
				VF Sa&Si	44
				LL	28.7
				PL	13.6
				PI	15.1
				FMC	15.8

319+00 E

0	-	10"	Tps		
0"	-	7 ⁰	Br M CI Till (wet to 3 ⁰)	<u>76AX63</u>	
				F&VF Sa	4
				Si	27
				CI	69
				VF Sa&Si	31
				LL	37.7
				PL	17.9
				PI	18.9
				FMC	19.2

533+30 E EBL

0	-	10"	Tps		
10"	-	8 ⁰	Br M CI Till (sat to 3 ⁰)		
8 ⁰	-	14 ⁰	Br & Gry M CI Till	<u>76AX64</u>	
				Br H CI - M CI	
				F&VF Sa	4
				Si	26
				CI	70
				VF Sa&Si	30
				LL	38.5
				PL	18.8
				PI	19.7
				FMC	22.4

416+16 35⁰ Rt E Blvd.

0	-	9"	Tps		
9"	-	10 ⁰	Br M CI Till (sat. to 3 ⁰)	<u>76AX65</u>	
				F&VF Sa	5
				Si	32
				CI	63
				VF Sa&Si	37
				LL	36.2
				PL	18.8
				PI	17.4
				FMC	18.2

387+00 30⁰ Rt E

0	-	9"	Tps		
9"	-	9 ⁰	Br M CI Till (sat. 3 ⁰)	<u>76AX66</u>	
				Br M CI	
				F&VF Sa	7
				Si	33
				CI	60
				VF Sa&Si	40
				LL	34.7
				PL	16.8
				PI	17.9
				FMC	17.5

DOCUMENT IDENTIFICATION

GEOCREs No. 40 E 13 - 33

DIST. 1 REGION SOUTHWESTERN

W.P. No. 42-46 - 14

CONT. No. 76-122

W. O. No. _____

STR. SITE No. 14 - 361

HWY. No. 402

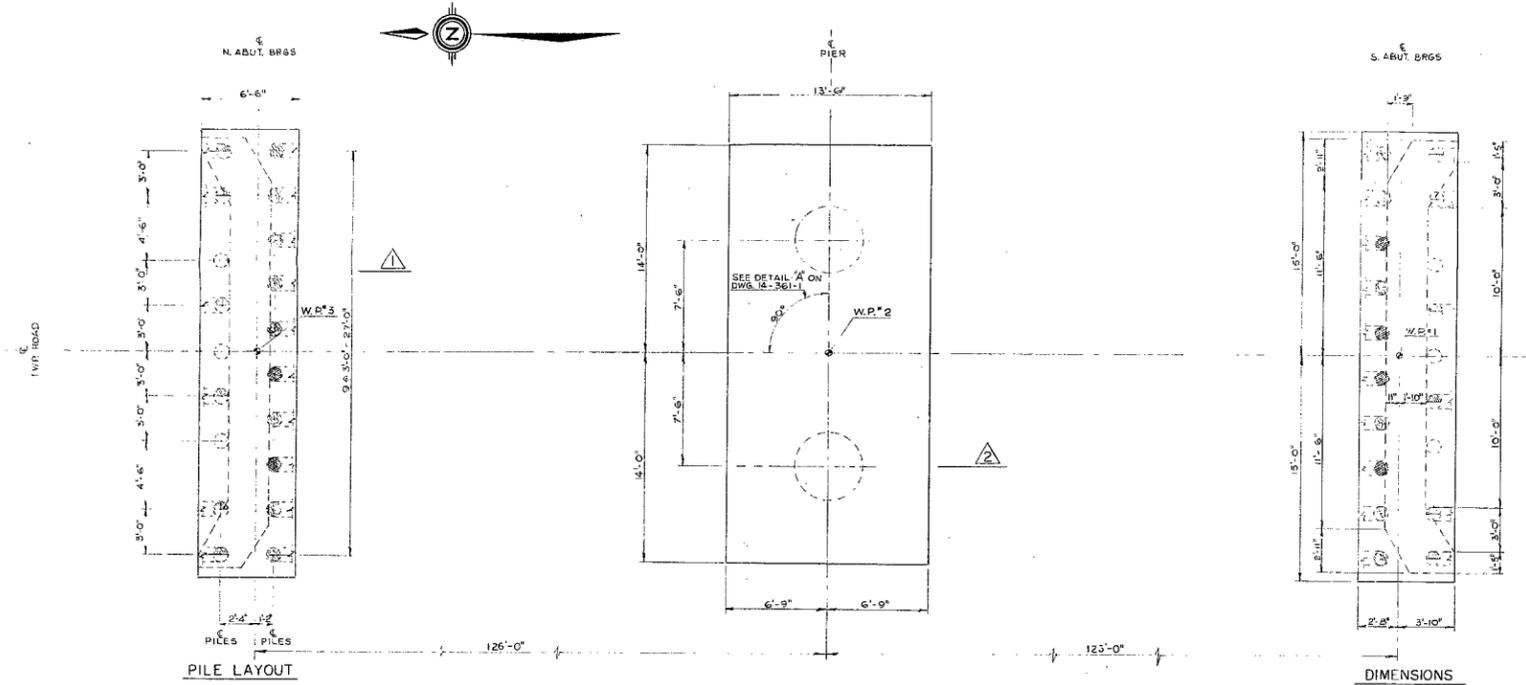
LOCATION TOWNSHIP ROAD UNDERPASS

OVERLAY INDICATED ON THESE DATA REPORT 3

REMARKS: _____

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS OUTRIG 88-81-15 4-74

DIST. No 1	○
CONT No	
WP No 42-66-14	
TOWNSHIP ROAD UNDERPASS	SHEET
FOUNDATION LAYOUT	



LEGEND

- ⊙ PILES BATTERED 3:1
- ⊗ PILES BATTERED 5:1
- ⊕ PILES BATTERED 8:1
- PILES DRIVEN VERTICALLY

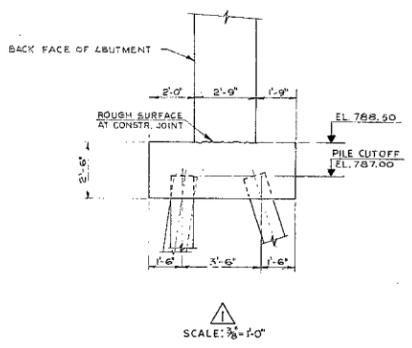
NOTES:

- DIMENSIONS AND PILE LAYOUT SIMILAR FOR BOTH ABUTMENT FOOTINGS.
- ABUTMENT PILE SPACING TO BE MEASURED AT UNDER SIDE OF FOOTING.
- ALL PILES ARE 12 3/8" O.D. x 0.25" WALL THICKNESS STEEL TUBE PILES.
- TUBE PILES TO BE FILLED WITH 3000 P.S.I. CONCRETE AFTER INSTALLATION AND INSPECTION.
- PILES TO BE DRIVEN IN ACCORDANCE WITH S53-II USING DESIGN LOAD 25 TONS/PILE BUT NOT BELOW EL. 750 WITHOUT APPROVAL OF THE ENGINEER.

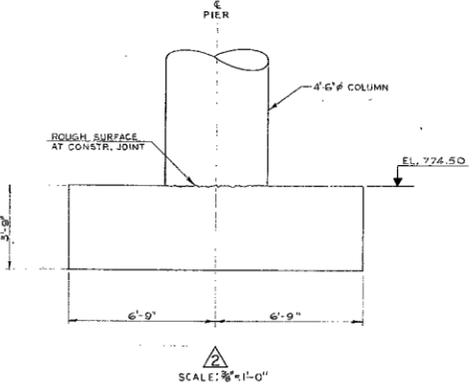
PILES SUPPLIED			
LOCATION	NO	LENGTH	TYPE
N. ABUTMENT	19	80'-0"	12 3/8" x 0.25" WALL THICKNESS STEEL TUBE PILES
S. ABUTMENT	19	80'-0"	STEEL TUBE PILES

CONCRETE QUANTITY IN TUBE PILES — 35.0 C.Y.

PLAN
SCALE: 1/8" = 1'-0"



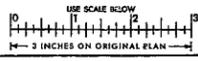
SCALE: 3/8" = 1'-0"



SCALE: 3/8" = 1'-0"



FOR REDUCED PLAN



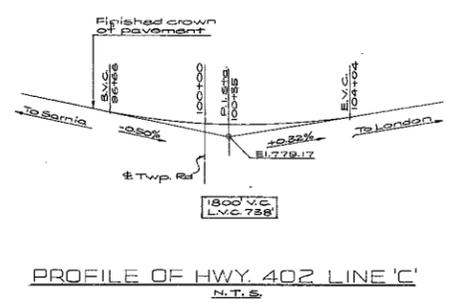
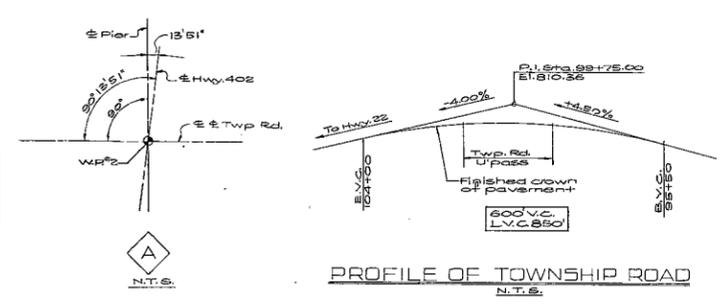
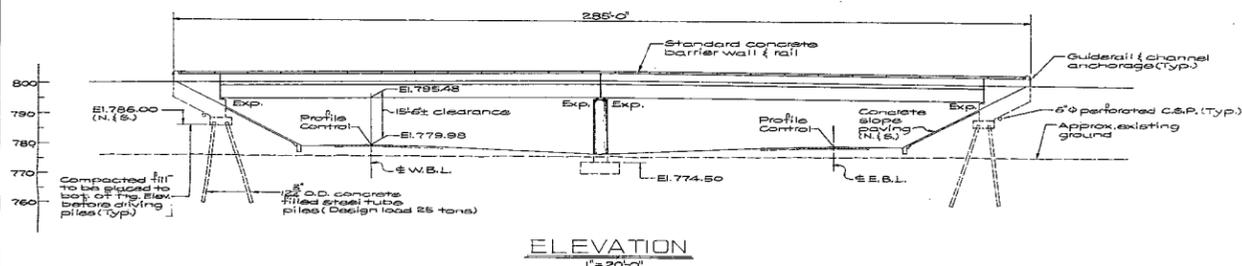
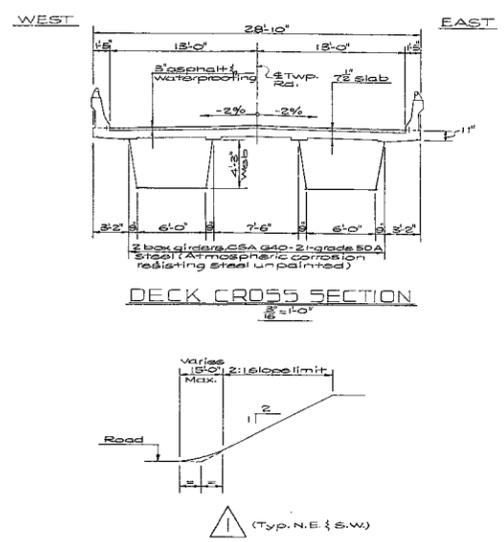
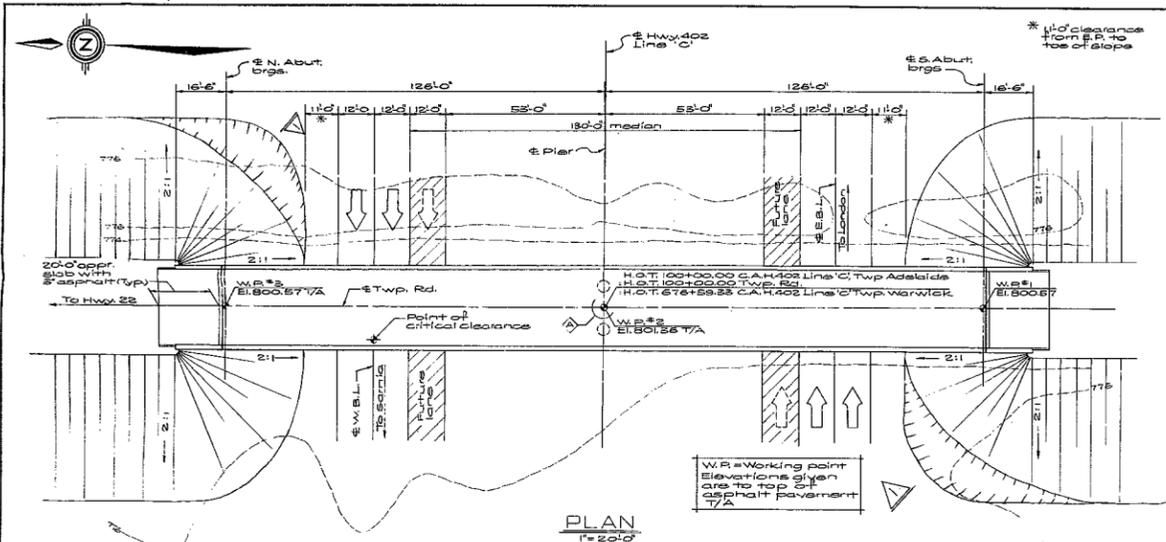
REVISION	DATE	BY	DESCRIPTION

DESIGN A.V. CHECK Z.K. LOADING MS20-44 DATE JAN 1976
DRAWING Z.K. CHECK A.V. SITE No 14-361 DWG 3



40 I 13-33

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO DB-88-10 4-75



DIST. No 1	SHEET
CONT No WP No 42-66-14	
TOWNSHIP ROAD UNDERPASS At London (Middlesex County) Line 42.66 miles east of Hwy 79	
GENERAL PLAN Hwy 402	

NOTES

Class of Concrete
Deck & barrier wall 4000 R.S.I.
Pier columns 4000 R.S.I.
Remainder 3000 R.S.I.
or as noted on drawings

Clear Cover on Reinf. Steel
Footings 5"
Abuts. (pier columns) 5"
Deck 2" top, 1" bot.
Barrier walls 1 1/2"
Approach slabs 2"
or as noted on drawings

Construction Notes
The Contractor is responsible for finishing the bearing seats dead level to the specified elevations with a tolerance of 1/8".
No concrete shall be placed above the abutment bearing seats until concrete in the deck has been placed.

Reinforcing Steel
Grade 60 is required for some of the deck reinforcing steel as identified on the deck drawing & rebar schedule.

Concrete Quantities
Concrete quantities are listed below for the appropriate concrete turn sum tender items:
Concrete in pier, abuts. 4000 R.S.I. 25 CY
{ wing walls } 3000 R.S.I. 79 CY
Concrete in deck 1988 CY
Concrete in barrier walls 50 CY
Concrete in approach slabs 35 CY
Concrete in slope paving 30 CY

Structural Steel Quantities
Total 156 tons

- LIST OF DRAWINGS**
- H-261-1 General Plan
 - " 2 Borehole Locations & Soil Strata
 - " 3 Foundation Layout
 - " 4 Abutments
 - " 5 Pier
 - " 6 Structural Steel
 - " 7 Bearings
 - " 8 Deck
 - " 9 Concrete Barrier Walls
 - " 10 Steel Parapet Railing
 - " 11 20 Ft. Approach Slab
 - " 12 Details of Conc Slope Paving
 - " 13 Standard Details I
 - " 14 Standard Details II
 - " 15 Standard Details III
 - " 16 As Constructed Elev. & Dim.

E.M. 776.92
Geodetic Datum
N.W. in NE part of O.S. map
277 Lt. 575+78 Line 'C'



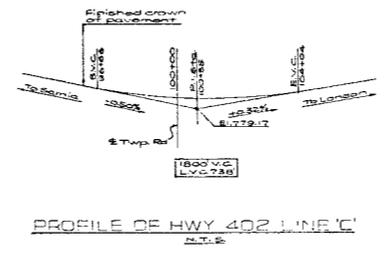
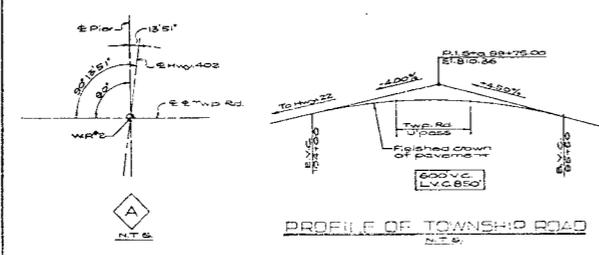
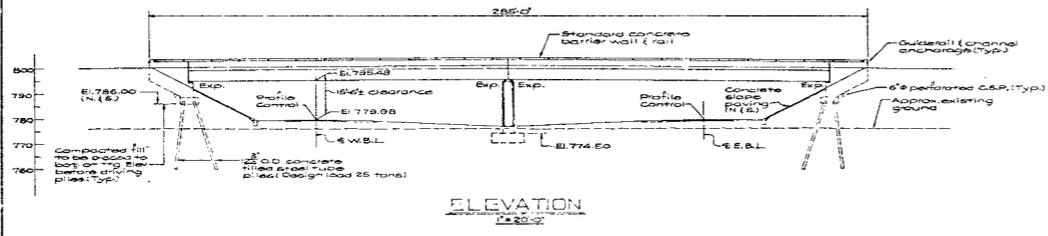
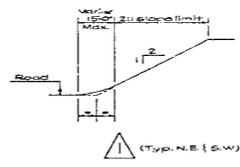
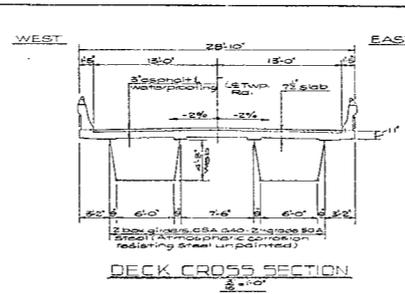
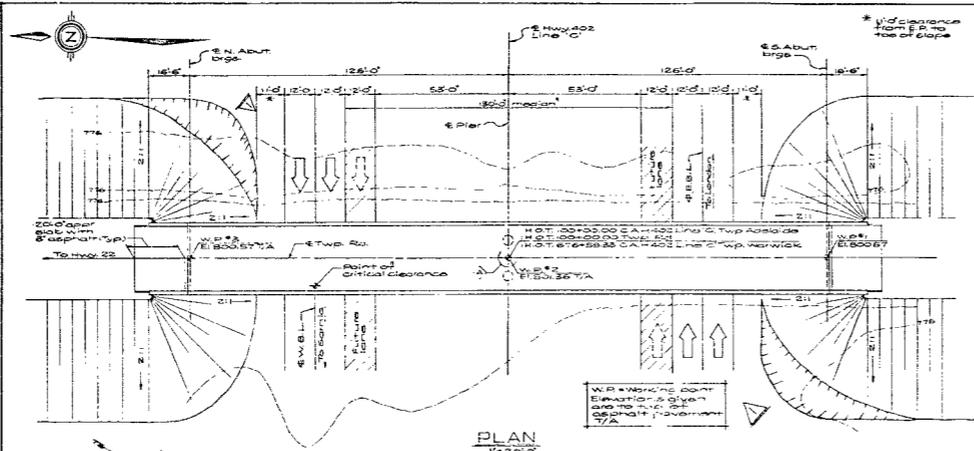
FOR REDUCED PLAN
USE SCALE BELOW
1" = 3 INCHES ON ORIGINAL PLAN

REVISION	DATE BY	DESCRIPTION

DESIGN A.R. CHECK K.S. LOADING H-20-44 DATE June 76
DRAWING DC CHECK A.K. SITE No 14-261 DWG 1

40I13-33

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS DRAWING 21-12-118-1-1



DIST. No 1
CONT No
WP No 42-66-14
TOWNSHIP ROAD UNDERPASS
GENERAL PLAN
40113-33

NOTES

Class of Concrete
Deck (Barrier wall)
Per column
Remainder
Clear Cover on Reinf. Steel
Footings
Abutts (Under columns)
Deck
Barrier walls
Approach Slabs
or as noted on drawings
Concrete Notes
The Contractor is responsible for the design and construction of the bridge structure with a minimum of 15%
No concrete shall be placed until the substructure bearing soil is fully placed
Reinforcing Steel
Grade 60 is required for some of the deck reinforcement. See identified on the deck drawing & rebar schedule

Concrete Quantities

Concrete quantities are listed below for the approximate concrete item. Burn tender items:
Concrete in piers, abutts, 4000 PSI 35 CY
Concrete in deck 1500 PSI 70 CY
Concrete in barrier walls 5000 PSI 50 CY
Concrete in approach slabs 35 CY
Concrete in slope paving 30 CY

Structural Steel Quantities

Total 135 tons

- LIST OF DRAWINGS**
- 1-261-1 General Plan
 - 2 Borings Locations & Soil Strata
 - 3 Foundation Layout
 - 4 Abutments
 - 5 Pier
 - 6 Structural Steel
 - 7 Bearings
 - 8 Deck
 - 9 Concrete Barrier Walls
 - 10 Steel Parapet Railing
 - 11 20 Ft. Approach Slab
 - 12 Details of Conc. Slope Paving
 - 13 Standard Details I
 - 14 Standard Details II
 - 15 Standard Details III
 - 16 As Constructed Elev. (Dim.)

TO BE USED FOR ESTIMATING PURPOSES ONLY

FOR REDUCED PLAN
1/4" SCALE
DATE: JUN 14 1976